Form. Number	Chemical Components	Drinking Water MOE[1,2]	Fish Ingestion MOE[1,2]	Inhalation MOE[1,2]
38	Hydrocarbons, petroleum distillates			
	Alkoxylated alcohols			
	Fatty acid derivatives			
39	Water			
	Hydrocarbons, petroleum distillates			8.0×10^5
	Propylene glycol ethers			1.0×10^6
	Alkanolamines	4.0×10^6		
	Ethylene glycol ethers			1.1×10^5
40	Hydrocarbons, aromatic			
	Hydrocarbons, petroleum distillates			8.0×10^5
	Fatty acid derivatives			
	Ethoxylated nonylphenol[3]	1.6×10^7		

[1] A Margin-of-Exposure (MOE) or a Hazard Quotient (HQ) gives an estimate of the "margin of safety" between an estimated exposure level and the level at which adverse effects may occur. Hazard Quotient values below unity imply that adverse effects are very unlikely to occur. The more the Hazard Quotient exceeds unity, the greater is the level of concern. High MOE values such as values greater that 100 for a NOAEL-based MOE or 100 for a LOAEL-based MOE imply a low level of concern. As the MOE decreases, the level of concern increases. The hazard values used in the HQ or MOE calculations were taken from Table 2-3. The exposure values used in the calculations were taken from Tables 3-4 and 3-5.

[2] The absence of HQ or MOE values in this table indicates no exposure is expected by this route or that insufficient hazard data were available to calculate a HQ or MOE for that chemical.

[3] Based on testing data (Weeks, A.J. et al. 1996. *Proceedings of the CESIO 4th World Surfactants Congress, Barcelona, Spain*. Brussels, Belgium: European Committee on Surfactants and Detergents, pp. 276-291.) the original estimate of POTW removal has been changed from 100% reported in the draft document to 95% in the final report. This revision results in increased estimates of releases to surface water. When the releases to surface water are compared with the concern concentration set at the default value of 0.001 mg/L, the formulations containing ethoxylated nonylphenols (formulations 4, 5, 7, 8, 9, 17, 24 and 40) present concerns to aquatic species that were not reported in the draft CTSA.

3.5 PROCESS SAFETY CONCERNS

Exposure to chemicals is just one of the safety issues that printers may have to deal with during their daily activities. Preventing worker injuries should be a primary concern for employers and employees alike. Work-related injuries may result from faulty equipment, improper use of equipment or bypassing equipment safety features, failure to use personal protective equipment, and physical stresses that may appear gradually as a result of repetitive motions (i.e., ergonomic stresses). Any or all of these types of injuries may occur if proper safeguards or practices are not in place and correctly used. The use of personal safety equipment and the presence of safety guards on equipment can have a substantial impact on business, not only in terms of direct worker safety, but also in reduced operating costs as a result of fewer days of absenteeism, reduced accidents and injuries, and lower insurance costs. Maintaining a safe and efficient workplace requires that employers and employees understand the importance of using personal protective equipment, have appropriate safeguards on mechanical and electrical equipment, store and use chemicals properly, and practice good ergonomic procedures when engaged in physical activity.

Training

A critical element of workplace safety is a well-educated workforce. To help achieve this goal, the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard requires that all employees at printing facilities (regardless of the size of the printing plant) be trained in the use of hazardous chemicals to which they are exposed, therefore, it is recommended that a formal training program be instituted for all workers at lithography plants. Training may be conducted by either facility staff or outside parties who are familiar with the lithography process and the pertinent safety concerns. The training should be held for each new employee, as well as periodic retraining sessions when necessary (for example, if new equipment is to be used), or on a regular schedule. The training program should explain to the workers the types of chemicals with which they work and precautions to be used when handling or storing them; when and how personal protection equipment should be worn; the need for other safety features such as machine guards and their proper use; and how to maintain equipment in good operating condition.

Storing and Using Chemicals Properly

Because lithographic printing requires exposure to and use of a variety of chemicals, it is important that workers know and follow the correct procedures for using and storing the chemicals. Much of the use, disposal, and storage information about blanket wash chemicals may be obtained from the Material Safety Data Sheets provided by the manufacturer for each chemical or formulation. MSDSs will also alert the workers to the need for appropriate personal protection equipment. All chemicals should be stored in appropriate storage space and should be labeled accordingly with all federal, state, and local regulations. Chemicals that are incompatible with other chemicals or that require special precautions in their use should also be appropriately labeled and stored. Because many of the chemicals used in blanket wash formulations are highly flammable, it is recommended that the facility be periodically inspected by the local fire marshall to ensure that the chemicals are stored properly and ventilated, thus reducing the potential for a fire.

Rags or towels that are used to wipe up chemicals or clean blankets may be considered hazardous waste by EPA and state and local agencies if they contain specified hazardous chemicals in sufficient amounts. These towels should be stored and disposed of in accordance with the federal, state, and local regulations. Blanket wash workers should also be aware of the potential for smoldering of the rags, particularly those that contain terpenes. If a printer is uncertain about whether or not the used rags or towels require special treatment as hazardous waste, he or she should contact their local state environmental agency, or state technical assistance program. For further information about the specific safety factors and hazards associated with specific chemicals used in lithography blanket wash formulations, such as flammability and corrosivity, see Section 2.2 Chemical Information.

Use of Personal Safety Equipment

Although EPA developed the Design for the Environment Program to assist industry in determining the environmental effects and risks associated with various industries, worker safety is the responsibility of OSHA. Many printers are already familiar with OSHA's Hazard Communication Standard which covers many aspects of worker safety for a variety of industries, including printing facilities. OSHA has already developed several personal protective equipment standards that are applicable to the printing industry. These standards address general safety requirements (29 CFR Part 1910.132), the use of eye and face protection (Part 1910.133), head protection (Part 1910.135), foot protection (Part 1910.136), and hand protection (Part 1910.138). The standards for eye, face and hand protection are particularly important for the printing industry where there is frequent contact with a variety of chemicals, such as solvents, dispersants, surfactants, and inks, that may irritate or otherwise harm the skin and eyes. In

order to prevent or minimize exposure to such chemicals, workers should be trained in the proper use of personal safety equipment. For many blanket wash chemicals, appropriate protective equipment includes goggles to prevent chemical from splashing into the eyes during the transfer of chemicals from large containers to small ones, aprons or other impervious clothing to prevent splashing of chemicals on clothing, and gloves. In some printing facilities with loud presses, hearing protection may be required or recommended.

Other personal safety considerations are the responsibility of the worker. Workers should be discouraged from eating or keeping food near presses or chemicals. Because presses contain moving parts, workers should also be prohibited from wearing jewelry or loose clothing, such as ties, that may become caught in the machinery and cause injury to the worker or the machinery itself. In particular, the wearing of rings or necklaces may lead to injury. Workers with long hair that may also be caught in the machinery should be required to securely pull their hair back or wear a hair net.

Use of Equipment Safeguards

In addition to the use of proper personal protection equipment for all workers, OSHA has developed safety standards that apply to the actual equipment used in printing facilities. These machine safety guards are described in 29 CFR Part 1910.212 and are applicable to all sectors of the industry, including lithography. Among the safeguards recommended by OSHA that may be used for lithographic printers are barrier guards, two-hand trip devices, and electrical safety devices. Safeguards for the normal operation of press equipment are included in the standards for mechanical power-transmission apparatus (29 CFR Part 1910.219) and include belts, pulleys, flywheels, gears, chains, sprockets, and shafts. The National Printing Equipment and Supply Association has made available copies of the American National Standard for Safety Specifications for Printing Press Drive Controls. These safety recommendations address the design of press drive controls specifically, as well as safety signaling systems for web and sheet-fed printing presses. Printers should be familiar with the safety requirements included in these standards and should contact their local OSHA office or state technical assistance program for assistance in determining how to comply with them.

In addition to normal equipment operation standards, OSHA also has a lockout/tagout standard (29 CFR part 1910.147). This standard is designed to prevent the accidental start-up of electric machinery during cleaning or maintenance operations that apply to the cleaning of blankets as well as other operations. This standard has posed particular problems for lithographers during minor, routine procedures such as cleaning the press which requires frequent stops and small movement of the rollers (inching) which may be accomplished without extensive disassembly of the equipment. For such cases, OSHA has granted an exemption for minor servicing of machinery provided the equipment has other appropriate safeguards, such as a stop/safe/ready button which overrides all other controls and is under the exclusive control of the worker performing the servicing. Such minor servicing of printing presses has been determined to include clearing jams, minor cleaning, lubricating, adjusting operations, plate and blanket changing tasks, paper webbing, and roll changing. Rigid finger guards should also extend across the rolls, above and below the area the be cleaned. Proper training of workers is required under the standard whether lockout/tagout is employed or not. For further information on the applicability of the OSHA lockout/tagout standard to printing operations, contact the local OSHA field office or the Printing Industries of America, Inc.

References

1. General Sciences Corporation. 1988. Exposure Screening Manual, May. (GSC-TR-32-88-015)

2. General Sciences Corporation. 1991. *Graphical Exposure Modeling System, GEMS, User's Guide*. (GSC-TR-32-91-001)

3. General Sciences Corporation. 1990. *GAMS Version 3.0 User's Guide*. (GSC-TR-32-90-010)

4. *1988 Rand McNally Commercial Atlas & Marketing Guide, (119th Edition)*. 1988. Rand McNally & Company.

5. U.S. Environmental Protection Agency. 1992. *Exposure Assessment Guidelines*, May.

6. U.S. Environmental Protection Agency. 1989. *Exposure Factors Handbook,* May. (EPA/600/8-89/043)

7. U.S. Environmental Protection Agency. 1992. *Industrial Source Complex (ISC2) Dispersion Models User's Guide,* March. (EPA-450/4-92008a).

8. Versar, Inc. 1995. *Electronic Consolidated Industrial Discharge Database*.

9. Versar, Inc. 1995. *ReachScan with PDM*. March 9.

10. Versar, Inc. 1991. *Stream Dilution Factors Program,* [Implementation in Lotus 1-2-3 Version 2.3].

11. CEB Manual. 1991.